IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(oracle01.028)

Applicant:	Ying Hu et al.	**Confirmation No.:** 9081	
Application No:	10/810,756	**Group Art Unit:** 2166	
Filed:	3/26/04	**Examiner:** Ahluwalia, Navneet K.	

Title: *A database management system with persistent, user-accessible bit map values*

Commissioner for Patents
Alexandria, VA 22313-1450

Response to a final Office action under 37 C.F.R. 1.116

Summary of the prosecution

Examiner mailed a restriction requirement in the above application on 11/27/2006 having a one-month response period. In the restriction requirement, Examiner found three groups of claims:

I: 1-47

II: 48-55

III: 56-57

Applicants responded to the restriction requirement by electing Group I without traverse and amending their claims accordingly.

On 3/8/2007, Examiner mailed a first Office action in the above application in which she rejected all claims under 35 U.S.C. 103 as obvious over the combination of U.S. published patent application 2005/0060293, Day, et al., *Background index bitmapping for faster query performance*, filed Sept. 11, 2003 (hereinafter "Day"), and U.S. Patent 5,844,396, Depledge, et al., *Updating bitmapped indexes*, filed Feb. 28, 1997 (hereinafter "Depledge"). Applicants amended their claims to overcome the rejection. The claims were amended to correspond to the claims in an Article 34 amendment in the

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International Preliminary Examination in PCT/US2005/009052 to overcome rejections based on the references cited in the International Search Report which was filed in the IDS of 6/19/2005 in the present application.

5   On 9/19/2007, Examiner mailed a final Office action in which she rejected all of the claims under 35 U.S.C. 103 as obvious over the combination of two new references: USSN 6,067,540, Ozbutun, et al., *Bitmap segmentation*, issued May 23, 2000 (hereinafter "Ozbutun") and U.S. Patent 6,026,398, Brown, et al., *System and method for searching and matching databases*, issued Feb. 15, 2000 (henceforth "Brown"). Applicants are
10   traversing the rejection. In the following discussion, locations in Applicants' Specification are cited using the paragraph numbers from the published application, which bears the publication number US 2005/0216518.

Traversal

15   The following *Traversal* will first discuss prior art bitmap indexes generally, then the relationship between Applicants' claims and the prior art, and will finally show that neither Ozbutun nor Brown discloses nothing beyond the prior art and that Applicants' claims are consequently patentable over the references.

20   *Prior-art bitmap indexes*

Applicants' *Background of the invention* points out at [0017] that relational database management systems have long provided bitmap indexes and provides a short description of prior-art bitmap indexes as they are implemented in the Oracle 9*i* relational database management system beginning at [0018]. As shown there, the user interface to these
25   bitmap indexes is SQL DDL statements which permit the user to specify that the relational database system construct a bitmap index on a field of a table and permit the user to specify that an existing bitmap index be dropped. The relational database management system then uses the bitmap index as described at [0014] for indexes generally: it automatically updates the bitmap index in response to changes in the table
30   the index belongs to and automatically uses the bitmap index to speed up queries on the table that involve the field indexed by the bitmap index. An example of using a bitmap

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index to speed up queries may be found at [0023]. Limitations of prior-art bitmap indexes are described at [0035]. Among these limitations is the fact that the user has no direct access to the primitive operations which the relational database system performs on the bitmap. Thus, as set forth at [0035], there is no operation which permits a user to make a bitmap value that represents the rowids returned by a user-defined query.

Applicants' claims and the prior art

Applicants' disclosure sets forth at [0039] than an object of Applicants' invention is to provide "a database management system in which programmers had access to bitmap values specifying subsets of large sets of values and to primitive operations for the bitmap values ...". Applicants' claim 1 as amended in the Applicants' response to the Office action of 3/8/2007 expressly sets forth such a relational database system:

> **1.** (currently amended) A database management system having the improvement comprising:
>> bitmap values, a bitmap value having a representation of a bitstring wherein set bits specify a set of objects whose definitions are built into the database management system, and
>> bitmap operations provided by the database system, a bitmap operation having user-specified operands which are bitmap values and/or sets of objects.

The language "a bitmap operation having user-specified operands which are bitmap values and/or sets of objects" clearly sets forth that the user has access to primitive operations on the bitmap values and thus distinguishes claim 1 from the prior art described in Applicants' *Description of related art*. Similar language specifying user access to primitive operations on the bitmap values is found in Applicants' other independent claims 22, 36, and 44.

Bitmap operations in the references

In her rejection, Examiner combines the Ozbutun reference and the Brown reference. As set forth at ¶6 of her final Office action, she finds the claimed "bitmap operation having user specified operands" in Ozbutun, but does not find "the operands as claimed", namely

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"operands which are bitmap values and/or sets of objects" in Ozbutun. For that limitation, Examiner turns to Brown

The Ozbutun reference

5   The Ozbutun reference is primarily concerned with dividing bitmap indexes into segments in order to reduce the size of the indexes and to reduce the granularity of operations such as compression, de-compression, locking, and logging which the relational database system automatically performs in the course of using and maintaining bitmap indexes (Ozbutun, *Abstract*). There is simply no disclosure anywhere in Ozbutun

10 which indicates that users have access to primitive operations on the bit map indexes. In her rejection of claim 1, Examiner cites FIG. 3A, col. 5, lines 58-67, col. 6, lines 20-26, and col. 7, lines 4-21 as showing the claimed "bitmap operation having user specified operands". FIG. 3A shows a table and FIG. 3B shows a segmented version of a standard prior-art bitmap index. Col. 5, lines 58-67 describes the figures; col. 6, lines 20-27

15 describes how if all of the indexed fields in a segment of a segmented bitmap have the same value, the segment will merely specify the range and the value. There is no indication in Ozbutun that a user can specify that a bitmap index be segmented or that the user can specify how it will be segmented.

20 Col. 7, lines 4-21 sets forth how segmenting a bitmap index speeds up operations involving the bitmap index. The described operations are, however, all operations that the relational database system automatically performs on the bitmaps in the course of using the bitmaps in query operations; none of them is "a bitmap operation having user specified operands", as required by the claim.

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The Brown reference

The disclosure of the Brown reference is well-described by the *Abstract*:

> In a database data processing system, input search data is matched against
> an index of a database to determine database records which either closely
30 > or exactly match the input search data. The input search data is broken
> down into elements, and elements are converted to terms having a finite
> set of possible values. The Soundex function may be used to convert
> elements to terms. The terms are compared against an index of terms to

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determine which database records relate to the input search data. Through statistical analysis, match records are given a record weight which may be used to calculate how closely the input data actually is to each match record. The invention provides a fast and efficient way of accurately searching for data in extremely large databases, while not requiring precise input search data entry. The invention may also be used to compare or supplement one database against another.

As is clear from the lack of any mention of bitmaps in the *Abstract*, Brown is only marginally concerned with bitmap indexes. They appear in Brown's disclosure only as one of the many kinds of indexes which may be used in Brown's system. The total disclosure concerning bitmaps in Brown consists of the following: col. 2, lines 20-34, which describe the use of bitmaps in inverted indexes, and col. 5, lines 1-8 and col. 11, lines 22-37 together with FIG. 15, which describe how bitmaps may be used to identify the database records to which a term set relates.

Examiner cites none of the disclosure concerning bitmap indexes in Brown. Instead, she cites to col. 14, lines 36-58, which must be understood in the context of the "flowchart of match engine processing shown in FIG. 7" (col. 9, lines 38-39). In overview, what the flowchart of FIG. 7 shows is how input data which is to be matched with records in a database is received (30), parsed into its elements (31), and is converted to terms belonging to a predetermined set of terms used in the database system (33). The terms resulting from the conversion are matched to records in the database system, with indexes being used in the matching (35). The indexes may of course be bitmap indexes. Once the records matching the terms have been returned, the records are filtered as shown in steps 36-40 to determine which records best match the criteria specified in the input data. The filtering is described beginning at col. 12, line 21. There are three stages to the filtering: by record weight (36), by applying a function to the results of the filtering by record weight (37), and if that function does not produce a match (38), applying a third function (40).

Col. 14, lines 36-58 cited by Examiner are part of the discussion of step 37. FIG. 11 is a list of the tests applied to the weights of the records received from the first stage of the filter. The meanings of the symbols used in the list are explained in the box labeled

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"Legend". As can be seen there, the tests involve record weights C from the first stage of the filter, record weights W from the second stage of the filter, constants K, and the mathematical mean, sum, min, abs, and sqrt operations. *None* of these functions have "user-specified operands" (the operands are the records which are the results of the first stage of the filtering), and even more to the point, *none* of these functions involve bitmaps either as operands or as results. Consequently, *none* of these functions can be taken to be the "bitmap operation" of the claim.

Patentability of the independent claims over the references

As Examiner well knows, a rejection of a claim under 35 U.S.C. 103 requires that the Examiner make a *prima facie* case of obviousness under MPEP 2142. One element of the *prima facie* case is that the combined references must show all of the limitations of the claim under rejection. As just set forth, *neither* Ozbutun *nor* Brown discloses "a bitmap operation having user-specified operands". Examiner has consequently not made the *prima facie* case required for the rejection. As Examiner will immediately understand, the argument just made with regard to claim 1 applies *a fortiori* to the bitmap operations set forth in independent claims 22, 36, and 44. Further, because the independent claims are patentable over the reference, so are all of the dependent claims.

Independent patentability of the dependent claims

Claims 2-11 all include additional limitations which further limit the "bitmap operation having user-specified operands" of claim 1, and since the references do not disclose such bitmap operations, they necessarily cannot disclose the additional limitations and claims 2-11 are independently patentable over the references. There is further no disclosure of the "bitmap values in user-specified fields" of claims 13 and 31, or of the claim 17's limitation that "the row identifiers [which are the operand in the bitmap operation] are "row identifiers returned by a user-defined query executed in the database management system" of claims 17 and 46 or of the further limitation in claim 18. There is also no disclosure in the references of bitmaps that specify anything other than row identifiers; consequently, claims 19, 20, and 38 are independently patentable over the references.

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Conclusion

Applicants have not amended their claims and have demonstrated that the claims are patentable over the references that were newly cited in the final Office action. Applicants consequently respectfully request that Examiner either allow the claims or withdraw the finality of the rejection and continue with her examination. No fees are believed to be required for this amendment. Should any be, please charge them to Deposit Account # 501315.

Respectfully submitted,

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